

## ASSESSMENT OF PLASMA URIC ACID LEVEL AMONG INDIAN FEMALES WITH THYROID DYSFUNCTION

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### ABSTRACT

**Objective:** A significant correlation between thyroid function and purine nucleotide metabolism has been established in hypothyroidism. On the contrary, the relationship between hyperthyroidism and purine metabolism is controversial. The aim of this study was to investigate the concentration of serum uric acid level in Indian females with thyroid dysfunction.

**Material and Method:** Two hundred women (hundred with hypothyroidism, and hundred with hyperthyroidism) with age range between (21-62 years) and duration of thyroid dysfunction between (1 month -6 years), in addition to hundred healthy women as control group.

**Results:** In comparison to the prevalence reported in the general population, a significant increase of hyperuricemia was found in the hypothyroid and hyperthyroid patients. In hyperthyroidism the hyperuricemia is due to the increased urate production, while in hypothyroidism the hyperuricemia is secondary to a decreased renal plasma flow and impaired glomerular filtration.

**Conclusions:** These studies conclude that, thyroid disorders cause's significant increases of serum uric acid level.

**KEYWORDS:** Uric Acid, Thyroid Dysfunction

### INTRODUCTION

Many biochemical pathways in the body can be affected by disturbance of thyroid hormones level, uric acid is one of this biochemical pathways. The association between hypothyroidism and hyperuricemia was first suggested in 1955 by Kuzell and colleagues (1), who examined 520 patients suffering from gout and found hypothyroidism in 20% of the males and in 30% of the females. Subsequent studies (2-10) confirmed this association, furthermore suggesting that hypothyroid hyperuricemia could be due to a decrease in both the renal plasma flow and urate excretion (11-14).

On the contrary, the association between hyperthyroidism and hyperuricemia has been controversial. In 1989 Ford *et al.* (15), in contrast with previous reports (16, 17), demonstrated that hyperthyroidism can cause hyperuricemia through the increase of purine nucleotide turn over and the decrease of renal urate excretion.

Other studies (18, 19) confirmed their findings and also suggested that hyperthyroid hyperuricemia might be corrected by antithyroid drugs such as methimazole. However, in 1999 Raber *et al.* (20) did not find any significant statistical difference in serum urate concentration between hyperthyroid patients and euthyroid ones.

Uric acid is a non-nitrogenous substance produced from purine metabolism, either from the breakdown of ingested

purine nucleic acid, or from tissue destruction. There are physiological interactions between thyroid hormones and uric acid synthesis and excretion. As these hormones affect most of the metabolic pathways in the body, purine metabolism is one of these metabolic pathways can be affected by disturbance in thyroid hormones, that can alter the uric acid level, which may lead to hyperuricemia (21). Here we report our experience regarding the relationship between uric acid metabolism and thyroid disorders, presenting data obtained from patients suffering from either hypothyroidism or hyperthyroidism.

## MATERIALS AND METHODS

The case-control study, included Indian female patients attending the New Medical college Hospital, Kota, in Rajasthan state in the period from October 2012 to December 2013.

The study covered two hundred female patients with thyroid dysfunction (100 with hypothyroidism, and 100 patients with hyperthyroidism). In addition to 100 healthy subjects as control group; clinical data was obtained from the subjects' history and recorded on a questionnaire sheet. Clinical assessment of the study group was done by a medical doctor and they were not suffering from other disorder like hemolytic anemia, renal and liver disorders. 2.5 ml of venous blood sample was collected in plain container, by using sterile disposable plastic syringe and aseptic condition, vein puncture technique was applied. The sample was centrifuged at 3500 rpm for 5 minutes, and stored at  $-20^{\circ}\text{C}$  temperature until analyzed. The serum uric acid was measured spectrophotometrically using uric acid Kites.

## STATISTICAL ANALYSIS

The statistical evaluation of the results obtained was carried out using ANOVA and T tests. The mean and standard deviation of uric acid were used to compare between the test and control group.

The P values were obtained using ANOVA and T tests. Correlation between serum uric acid and both age and duration of hypo and hyperthyroidism was done. P- Values  $< 0.05$  were considered to be statistically significant.

## RESULTS

The study covered 300 subjects in Kota, Rajasthan state, 200 test subject, (100 subjects with hypothyroidism, with age range (21-61) years and duration (1 month-4 Years), 100 subjects with hyperthyroidism, with age range (21-62) years and duration of (6 month-6 years) and 100 subjects volunteers (21-62) years as control group, to determine the serum uric acid level.

As evident in Table 1, there is significant increase in the level of uric acid in both hyper and hypothyroidism test groups when compared with control group ( $6.8 \pm 1.67$  mg/dl and  $6.5 \pm 1.68$  mg/dl versus  $4.0 \pm 0.87$  mg/dl respectively), ( $p < 0.05$ ), in table 1 & 2. Whereas there is no significant difference between the hypo and hyperthyroidism ( $p > 0.05$ ) as shown in table 2.

As presented in table 3 there is insignificant correlation between serum uric acid level with duration of both hypo and hyperthyroidism ( $r = 0.037, p = 0.805$ ) and ( $r = -0.089, p = 0.551$ ) respectively. Also there is no significant correlation between serum uric acid level with the age in both hypo and hyperthyroidism patient ( $r = -0.138, p = 0.340$ ) and ( $r = -0.240, p = 0.095$ ) respectively.

**Table 1: Descriptive Statistic of Plasma Uric Acid Level and T3, T4 and TSH in Hypo and Hyperthyroidism Patients with Their Control**

Parameters	Hypothyroidism N=100	Hyperthyroidism N=100	Control N=100
Uric Acid mg/dl	6.53 ±1.68	6.80 ±1.67	4.0±0.86
T3 pmol/l	2.0 ±0.6	5.5 ±1.3	2.4 ±1.2
T4 pmol/l	4.4±2.3	159.5 ±12.5	6.7±1.5
TSH mU/L	85 ±5.5	1.2± 0.3	1.55±1.4

**Table 2: A NOVA for Comparison of Plasma Uric Acid Level in Hypo and Hyperthyroid Dismpatients with Their Control**

Groups	Mean Difference	Significant
Hypothyroidism + control	2.51	0.000*
Hyperthyroidism + control	2.69	0.000*
Hyperthyroidism +	0.172	0.557

\* The difference is significant at  $p \leq 0.05$

**Table 3: Correlation between Serum Uric Acid Levels with Duration of Disease, Ages in Both Hypo and Hyperthyroidism Patients**

Groups	Parameter	Statistic	Ages in year	Duration
		Pearson correlation(r)	-0.138	0.037
Hypothyroidism	Uric acid level	Significance	0.340	0.805
		Pearson correlation(r)	-0.240	-0.089
Hyperthyroidism	Uric acid level	Significance	0.095	0.551

## DISCUSSIONS

Our study evaluated the possible inter-relationship between purine nucleotide metabolism and thyroid endocrine disorders, in particular primary hypo- and hyperthyroidism, by examining the data in the literature and comparing this with the data observed in our study. In the literature, while the correlation between hypothyroidism and hyperuricemia is well established (1-14), the connection between hyperthyroidism and hyperuricemia still appears to be under debate (15-20).

Many biochemical pathways in the body can be affected by disturbance of thyroid hormones level, uric acid is one of this biochemical pathways. In the current study plasma uric acid is significantly increased in test group with hypothyroidism, which agree with that obtained by Devika et al 2009. Hypo secretion characterized by decrease thyroid hormones level (T3 and T4), deficiency of these hormones cause significant reversible changes in renal function such as decrease in sodium reabsorption in the proximal tubule, a decrease in urate excretion, and a decrease in renal blood flow and glomerular filtration rate (ref). The cause of decrease renal blood flow is believed to be mainly due to the generalized hypodynamic state of the circulatory system in hypothyroidism that causes the elevation of uric acid level as in this study (11).

In the present study plasma uric acid is significantly increased in test group with hyperthyroidism, which agree with that obtained by Jeff 2008, hypersecretion attribute to increased level of thyroid hormones (T3 and T4), cause increased in the metabolic rate of the metabolites such as purine, which result in increased production of uric acid in the blood, that exceed the renal capacity to excrete uric acid, which may accumulate in joints causing gout, or deposited in the renal causing renal stone(12).

In the present study there is no significant correlation between serum uric acid level with both age and duration of both hypo and hyperthyroidism.

## CONCLUSIONS

The present study shows that hyperuricemia is a common feature not only of hypothyroidism, but also of hyperthyroidism. Therefore, we would emphasize the importance of the routine evaluation of serum and urinary uric acid levels, both in patients affected by hypothyroidism and in patients with hyperthyroidism. In this way we will be able to correct the possibly altered purine nucleotide metabolism and to prevent the onset of gout, which can worsen thyroid endocrine disorders.

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